

Gunshot Injury in the Neck With an Atypical Bullet Trajectory

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Abstract Gunshot injuries are on a rise in both developed and developing countries, the reason for this may be increased access to firearms. Gunshot injuries to the neck and maxillofacial region are associated with high morbidity and mortality due to the complex anatomy and presence of various vital structures in this region. It is indeed a rare finding that a bullet's trajectory passes through the neck region and does not damage any vital structures. We present one such case of gunshot injury to the neck.

Keywords Gunshot · Injury · Penetrating trauma

Introduction

Gunshot injuries cause profound morbidity and significant mortality, especially if they occur in the neck. These injuries occur in both military and civilian settings. Causes of these injuries may be homicidal or suicidal, and in rare cases, it may be accidental. The high density of vital structures in the neck makes injury to this region highly morbid and often fatal. The trachea, esophagus, carotid and vertebral arteries, cervical spine and spinal cord, phrenic

nerve and brachial plexus are all vulnerable with injury with neck trauma [1]. Each of these is a vital structure, and any delay in diagnosis and treatment can have devastating consequences [14].

Case Report

A 32-year-old male reported to the casualty of our centre, approximately 2 hours after sustaining a single gunshot wound to the left posterior cervical region of the neck. His chief complaint was neck pain. No neurological deficit was noted on examination. He was conscious. Sensory examination was intact for pin prick and light touch throughout, and the vital signs were within normal limits. The bullet entrance wound was in the left posterior cervical region of the neck, above and medial to the scapula. No possible exit wound for the bullet could be identified anywhere else on the head and neck region. The patient had not seen the assailant as it was night time and the bullet had been fired from behind his back. Because of the same reason, neither the type of weapon used to fire the bullet, nor the distance between the weapon and the patient was known and could not be judged. Both carotid pulses were palpable, and there were no carotid bruits. Initial radiographic (Figs. 1, 2) and CT scan (Figs. 3, 4) studies showed a bullet fragment in the left side of the neck at the levels of C6 and C7. It appeared to be a civilian gunshot injury.

Surgical site was prepared, marked and surgical exploration of the left anterior cervical region was performed using C-arm (X-ray image intensifier) to locate the bullet under general anesthesia (Figs. 5, 6). The bullet was identified and removed (Figs. 7, 8). Post operative period was uneventful.

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Fig. 1 AP view of cervical spine shows a bullet fragment at the level of C6 and C7



Fig. 2 Lateral view of cervical spine shows a bullet fragment at the level of C6 and C7

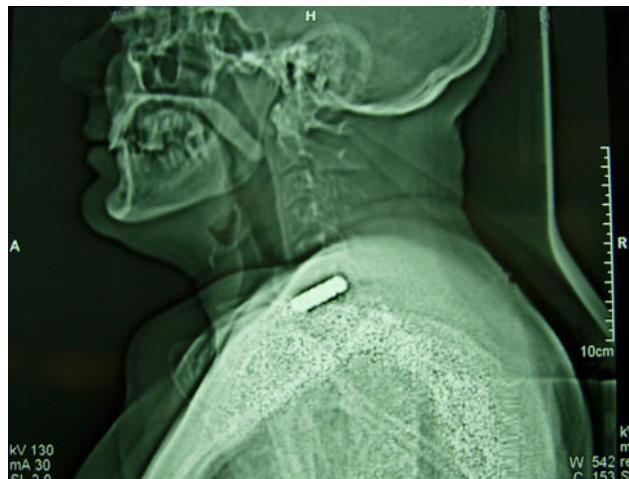


Fig. 3 CT Scan showing bullet at level of C6

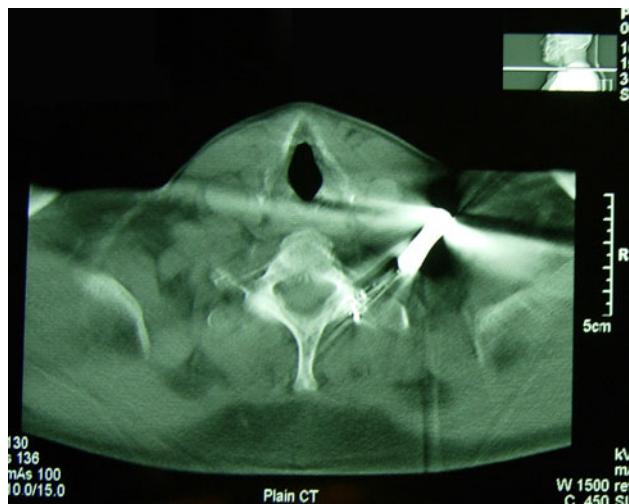


Fig. 4 Axial section of CT image showing bullet



Fig. 5 Preoperative view showing location of bullet and incision marking

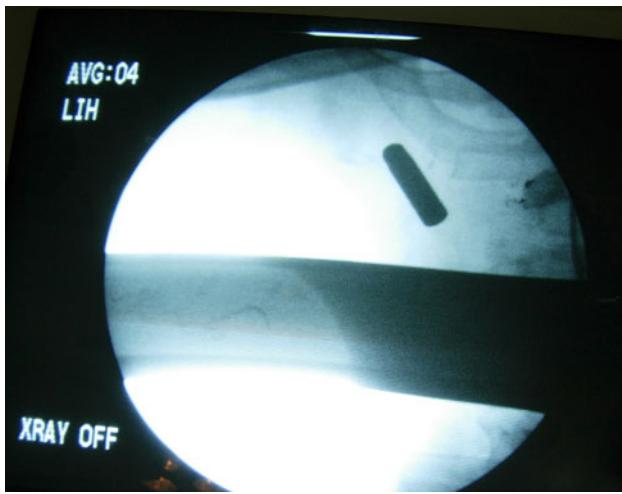


Fig. 6 C-arm image to locate the bullet during surgical exploration

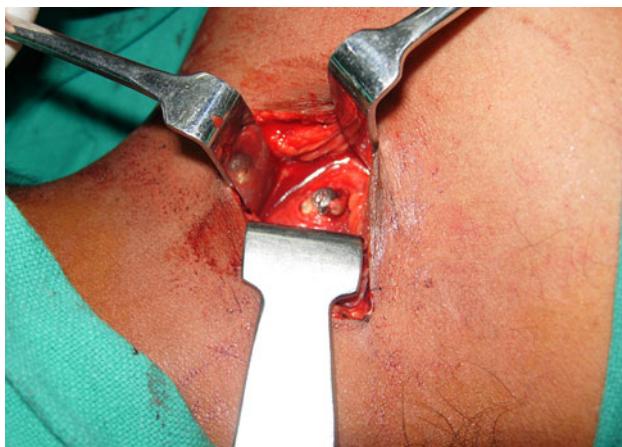


Fig. 7 Exposure of bullet



Fig. 8 Retrieved bullet

Discussion

Anatomic Considerations

These are very important in evaluating penetrating neck injuries. The trajectory of the knife or the bullet determines

anatomic injury. The platysma serves as an important superficial landmark, as patients without violation of this layer are less likely to have injury to deeper structures. If the platysma is violated, the chance of severe injury to deeper neck structures increases. Immediate surgical exploration of the neck is required in the following instances, regardless of the site of injury—airway compromise, extensive subcutaneous hematoma, pulsatile hematoma, active bleeding, and shock [1].

Incidence and Mortality

The overall mortality from penetrating neck trauma is as high as 11%. Injuries to vital structures may be fatal in two-thirds of all cases [15].

Classification and Staging Systems

The lateral neck is divided into three zones; this system is useful in the evaluation and treatment of penetrating neck injuries [1, 14].

Zone 1 extends from the clavicle to the cricoid cartilage and includes the thoracic inlet. This region contains the major vascular structures of the subclavian artery and vein, jugular vein, and common carotid artery, as well as the esophagus, thyroid, and trachea.

Zone 2 extends from the cricoid to the angle of the mandible and contains the common carotid artery, internal and external carotid arteries, jugular vein, larynx, hypopharynx, and cranial nerves X, XI, and XII.

Zone 3 is a small but critical area extending from the angle of the mandible to the skull base. This region contains the internal and external carotid arteries, jugular vein, lateral pharynx, and cranial nerves VII, IX, X, XI, and XII. As per the above zoning criterion present case falls into zone 1 injury.

Gant and Epstein [2] first gave a staging system for penetrating facial trauma. The same was later depicted pictorially by Gussack and Jurkowich [3]. The Gussack and Jurkowich system divided the face into entry zones I, II and III. Zone I was superior to supra orbital rims, zone II was from supraorbital rims to the oral commissure, and zone III was below the oral commissure. The Gant and Epstein system was further modified by Dolin et al. [4] into zones A, B and C. Zone A represented the lateral face zygomatic arch and the mandibular ramus, zone B represented the anterior midface and zone C represented the anterior mandible. But they were unclear as penetrating trauma in both zones A and B resulted in similar patterns of injury. Cole et al. [5] and Chen et al. [6] later simplified this and designated two entry zones, face and mandible. This is of particular importance, because the maxilla and the mandible show different and distinct patterns of injury.

Table 1 Complications of penetrating injuries in head and neck region

Complications of penetrating face injury	Complications of penetrating neck injury
Blindness, visual loss or diplopia	Airway obstruction
Facial nerve paresis or paralysis	Pharyngo-cutaneous fistula
CSF leak	Neck abscess
Soft tissue and/or bone loss	Mediastinitis
Trismus and/or malocclusion	Vocal cord paresis
Oro-antral fistula and sinusitis	Cervical spine osteomyelitis
Nasal obstruction	
Non union or mal union of bone	

Sherman and parish [7] have classified shotgun injuries into three groups. Long range injuries (type 1 = more than 7 yards distance between the weapon and the victim) are characterized by subcutaneous or deep fascial injuries only. Medium range injuries (type 2 = 3–7 yards distance) are characterized by injuries to the structures deep to the deep fascia, and short range injuries (type 3 = under 3 yards distance) are characterized by massive tissue destruction.

Mechanism of Injury

Gunshot Wounds Cause Injury by three mechanisms—direct tissue injury, temporary cavitation and transmission of shock waves. High velocity bullet wounds tend to follow a direct and predictable pathway, while low velocity bullets have a more erratic trajectory. Also, bullets have rotational characteristics that increase the possibility of an unusual and unpredictable course after impact. The rotation and tumbling of the projectile causes increased direct tissue damage [1].

Management

Surgical management of facial gunshot wounds, according to Motamedi [9], is generally divided into three stages—(1) debridement, fracture stabilization, and primary closure; (2) reconstruction of hard tissues, provided soft tissue coverage is adequate; and (3) rehabilitation of the oral vestibule, alveolar ridge, and secondary correction of residual deformities. Often, more than one operation may be performed in any stage. Early definitive and comprehensive treatments of the facial injury is the mainstay of treatment, and when included in the first stage, with minimal debridement, have been shown to result in lower morbidity.

Hollier et al. [8] have stated that the severity of injury resulting from facial gunshot wounds varies according to the caliber of the weapon used and to the distance from which the patient is shot. Close range, high-velocity gunshot wounds and shotgun wounds can result in devastating

functional and aesthetic consequences for the patient. Early management of these patients must focus on the basics of resuscitation, with paramount attention given to the status of the airway. Bleeding from the injury and the subsequent swelling associated with it can significantly compromise the airway. Control with either an endotracheal tube or tracheostomy should be considered early. Following this, hemodynamic resuscitation should be performed, if necessary, followed by thorough patient evaluation to rule out concomitant injuries [8].

Penetrating injuries of the head and neck present complex management problems because of the major vascular, neural, aerodigestive and ocular structures that are at risk. Mandatory exploration is very sensitive in identifying significant neck injuries and is associated with a low morbidity rate. However, up to 70% of patients explored in this way will have no injury to vital structures [9–14] (Table 1).

Conclusion

The four main steps in the management of patients with gunshot wounds to head and neck region are: securing an airway, controlling haemorrhage, identifying other injuries, and repair of the residual traumatic deformities. Our report illustrates that knowledge of the path of the projectile and its termination, and a thorough clinical evaluation of the patient are critical factors for the assessment and management of patient with gunshot wounds.

Conflict of interest None

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